

## WALK-BEHIND TILLER

### FIELD OF THE INVENTION

[0001] The present invention relates to a walk-behind tiller and, more  
5 particularly, to an improved loop-shaped handle extending obliquely from the  
rear of a tiller body rearwardly upwardly.

### BACKGROUND OF THE INVENTION

[0002] This kind of loop-shaped handle is disclosed, for example, in  
Japanese Utility Model Laid-Open Publication No. SHO-63-44310. This handle  
10 has a vertical position adjusting structure so that the handle is vertically  
adjustable to a height. This handle structure will be described with reference to  
FIGS. 14 and 15 hereof.

[0003] Referring to FIGS. 14 and 15, the handle 100 is loop-shaped handle  
and has a pair of left and right handle bars 102, 102 obliquely extending  
15 rearwardly upwardly from a handle mounting portion 120 provided at the rear  
of a tiller body (not shown), and a linear horizontal handle bar 103 extending  
transversely of the body for connecting the rear ends of the handle bars 102,  
102.

[0004] A C-shaped member 104 protruding toward the tiller body is  
20 mounted to a central portion of the horizontal handle bar 103. A vertical  
position adjusting grip lever 105 for controlling the relative height of the bar to  
the tiller body is attached to the C-shaped member 104.

[0005] To the proximal end of the handle 100, as shown in FIG. 15, an arc  
member 106 with a plurality of pin holes 107 formed above and below is  
25 mounted. A lock pin 108 to be fitted into or removed from one of the pin holes  
107 is connected to a release wire 109 which in turn is connected to the vertical  
position adjusting grip lever 105.

[0006] To the rear of the left and right handle bars 102, 102, clutch grip levers 130, 130 for on/off control of clutches (not shown) are attached via release wires 131, 131 connected to the clutches.

[0007] The above handle 100 structure requires adjustment of height of the handle 100 so as to correspond to different work postures taken for tilling, mere traveling and other operations with the tiller. The height adjustment is made by holding the grip lever 105, pulling the release wire 109, releasing the engagement between the lock pin 108 and one of the pin holes 107, and then aligning the lock pin 108 with one of the pin holes 107 corresponding to the height to which the handle 100 is to be adjusted, releasing the grip lever 105, engaging the lock pin 108 with the pin hole 107, and thereby adjusting the handle 100 to a desired height.

[0008] The above handle structure allows comfortable work postures for which, however, it requires the operation of engaging and disengaging the lock pin 108, taking time in height adjustment. The above vertical position adjustment configuration consists of a number of components and is thus complicated, making it difficult to reduce production costs. For operating the clutches with the above clutch grip levers 130, 130 when performing tilling operation holding the horizontal handle bar 103, it is required to change the positions of the hands to the left and right handle bars 102, 102. This results in the problem that the effect of forming the handle 100 in a loop cannot be exerted.

[0009] Another example tiller with a pair of left and right bar handles extending obliquely from the rear of a tiller body rearwardly upwardly and arranged to be vertically adjustable at their proximal ends is disclosed in Japanese Utility Model Laid-Open Publication No. HEI-2-134801. This tiller is shown in FIG. 16 hereof.

[0010] Referring to FIG. 16, the tiller 200 has a handle supporting member 211 provided on an upper central portion of a tiller body 210 and extending rearward. A pair of left and right bar handles 220 is vertically swingably attached to a rear end portion of the handle supporting member 211 via a shaft 212. The bar handles 220 can be adjusted in height by unfastening a handle height adjustment lever 213, then vertically swinging the bar handles 220, and fastening the lever 213 at a desired height, so that the handle height can be changed according to working conditions.

[0011] While the above tiller 200 provided with the handle height adjustment lever 213 can improve the work posture of an operator, it has the problem of an increased number of components and increased production costs.

[0012] As another example of a clutch lever configuration for controlling a tiller in which clutch levers are formed in loops like an operating handle is disclosed, for example, in Japanese Patent Laid-Open Publication No. HEI-5-8653. This clutch lever configuration is shown in FIG. 17.

[0013] Referring to FIG. 17, a looped driving clutch lever 302 and working clutch lever 303 are swingably supported on a rear lower portion of a looped operating handle 300 via a bracket 301. The two clutch levers 302, 303 are provided in proximity but are so far from a handle grip 300a that it is required to unhand the handle grip 300a to switch the clutch levers 302, 303 from off to on, resulting in the problem of reduced clutch operability.

[0014] In this context, there is a demand for a walk-behind tiller which allows for comfortable work postures in different operations and improves maneuverability of a clutch lever.

## SUMMARY OF THE INVENTION

[0015] According to the present invention, there is provided a walk-behind tiller comprising: a body; a pair of left and right travel wheels mounted to

opposite ends of an axle extending transversely of the body; a tilling device provided on the body forwardly of the travel wheels; and a loop-shaped handle having proximal portions extending from rear portions of the body obliquely rearwardly upwardly. The loop-shaped handle comprises left and right  
5 horizontal grips extending rearwardly substantially horizontally from rear ends of the handle proximal portions; left and right rising portions extending upwardly from rear ends of the left and right horizontal grips substantially orthogonally to the oblique handle proximal portions; and a cross portion interposed between upper ends of the left and right rising portions, whereby the  
10 left and right horizontal grips are held for holding the tiller substantially horizontally, the left and right rising portions are held when the tiller is in operation, and the cross member is held for forcing the handle down.

[0016] For moving or turning the tiller, it is necessary to lift the tilling device and hold it apart from the traveling surface, whereupon the operator can  
15 manually hold the cross portion of the handle to position the arms at an angle suitable for constantly applying force without stooping, turning the tiller in a comfortable work posture.

[0017] In tilling operations in which the handle having the left and right rising portions is lifted up, the operator grips the left and right rising portions  
20 for operations. That is, by manually holding the left and right rising portions, the operator can apply an oblique pressure force in a forward and downward direction by the hands and arms to the tilling device in a natural posture. Thus, when the operation changes into a tilling operation, the operator can also work in a comfortable posture.

25 [0018] For holding the handle having the left and right horizontal grips approximately horizontally, the left and right horizontal grips are held. Specifically, for operations other than tilling operations with the tilling device,

such as ridging operations with a ridger connected to the tiller or ditching operations with a ditch scoop connected to the tiller, the operator can manually hold the left and right horizontal grips to cause the holding power of the hands and arms to act at the tilling device and another operating device such as a  
5 ridger or a ditch scoop in a natural posture. The operator can thus work in comfort at all times during operations other than tilling operations.

[0019] For holding the handle having the left and right horizontal grips substantially horizontally, the left and right horizontal grips are held. This facilitates controls for stabilizing the work position of the tiller body such as  
10 lateral balancing of the body or fine adjustment of vertical position of the handle, allowing good results of other operations such as ridging and ditching.

[0020] The handle is a looped steel pipe and has a simple configuration including at least the left and right horizontal grips and left and right rising portions, resulting in reduction in handle production costs.

15 [0021] Preferably, the tiller further comprises a clutch lever provided at the loop-shaped handle, which clutch lever comprises: left and right supported ends swingably supported on at least one of the left and right horizontal grips; left and right lever horizontal portions extending rearwardly from the left and right supported ends and shaped correspondingly to the left and right horizontal  
20 grips of the handle; and left and right lever forwardly-tilted portions extending upwardly from rear ends of the left and right lever horizontal portions and shaped correspondingly to the left and right rising portions of the handle.

[0022] For working the soil with the tiller, the handle is lifted to cause the tilling device to dig into the traveling surface. At that time, the operator can put  
25 the fingers on the lever forward-tilted portions while putting the hands on the left and right rising portions of the handle and hold the rising portions and the lever forward-tilted portions of the clutch lever together. Thus, for manually

operating the clutch lever for working the soil, it is not necessary to change the current positions of the hands holding the rising portions of the handle.

[0023] The clutch lever of the tiller according to the present invention has the left and right lever forward-tilted portions having a shape corresponding to the shape of the left and right rising portions of the handle, so that the lever forward-tilted portions are positioned in proximity to the rising portions of the handle, resulting in improved operability.

[0024] The clutch lever has the left and right lever horizontal portions having a shape corresponding to the shape of the left and right horizontal grips of the handle. For operations other than tilling operations with the tilling device such as ridging operations with a ridger connected to the tiller or ditching operations with a ditch scoop connected to the tiller, the operator can put the fingers on the lever horizontal portions while putting the hands on the left and right horizontal grips of the handle and hold the horizontal grips and the lever horizontal portions of the clutch lever together. Thus, for manually operating the clutch lever for operations other than tilling operations, it is needless to change the current positions of the hands holding the horizontal grips of the handle.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0025] A preferred embodiment of the present invention will be described in detail below, by way of example only, with reference to the accompanying drawings, in which:

[0026] FIG. 1 is a perspective view of a walk-behind tiller according to the present invention;

[0027] FIG. 2 is a side view of the walk-behind tiller according to the present invention provided with a ridger;

[0028] FIG. 3 is a plan view of the tiller shown in FIG. 2;

- [0029] FIG. 4 is a plan view of a handle and clutch lever shown in FIG. 3;
- [0030] FIG. 5 is a side view of the handle and clutch lever shown in FIG. 4;
- [0031] FIG. 6 is an exploded perspective view of the handle and clutch lever shown in FIGS. 3 and 4;
- 5 [0032] FIG. 7 is a diagram illustrating the movement of the clutch lever from the state of the clutch lever shown in FIG. 5;
- [0033] FIGS. 8 and 9 are diagrams illustrating operation with the tiller with a cross portion of the handle and a lever horizontal portion of the clutch lever gripped;
- 10 [0034] FIGS. 10 and 11 are diagrams illustrating operation with the tiller with left and right rising portions of the handle and left and right lever forward-tilted portions of the clutch lever gripped;
- [0035] FIGS. 12 and 13 are diagrams illustrating operation with the tiller with left and right horizontal grips of the handle and left and right lever
- 15 horizontal portions of the clutch lever gripped;
- [0036] FIG. 14 is a diagram of a conventional loop-shaped handle provided to a tiller;
- [0037] FIG. 15 is a diagram of a lock mechanism of the handle shown in FIG. 14;
- 20 [0038] FIG. 16 is a side view of a conventional tiller provided with a vertically adjustable handle; and
- [0039] FIG. 17 is a diagram of a conventional loop-shaped handle having a looped clutch lever.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

- 25 [0040] A walk-behind tiller (hereinafter referred to merely as a "tiller") 10 according to the present invention shown in FIGS. 1 to 3 includes a body 11, an engine E provided on the body 11, a power transmission 12 mounted to the body

11, left and right travel wheels 13, a tilling device 15, and an operating machine such as a ridger 17 provided behind the travel wheels 13, for tilling agricultural field with the tilling device 15 while furrowing. The power transmission 12 transmits power generated by driving of the engine E to the left and right travel  
5 wheels 13 and to the tilling device 15.

[0041] As shown in FIG. 2, the power transmission 12 is mounted below a clutch case 11a containing a clutch provided below the engine E. The tilling device 15 is rotatably mounted to the front of the power transmission 12 via a rotor shaft 15a. The left and right travel wheels 13 are rotatably mounted to the  
10 rear of the power transmission 12 via an axle 13a. A handle 18 obliquely extends from the rear of the power transmission 12 in a rearward and upward direction. A connecting mechanism 21 for connecting the ridger 17 is mounted to the rear end of the power transmission 12. Reference sign G denotes a traveling surface.

[0042] A travel assisting wheel 31 is mounted to a front end portion of the  
15 power transmission 12 in a vertical-position-adjustable manner. A fender 32 covers the power transmission 12 and the tilling device 15 from above. The engine E is covered by an engine cover 33. Reference numeral 34 denotes an air cleaner, and 35 a fuel tank filler cap. The ridger 17 is turned up by operating a lifting lever 41 and is adjusted in sinking position by the operation of a vertical  
20 position adjustment lever 42.

[0043] Reference numeral 36 designates a shift lever; 37 a differential lock lever; and 38 a clutch lever.

[0044] As shown in FIG. 3, a recoil starter knob 51 for starting the engine E, a throttle lever 52 for controlling the output of the engine E and the diff-lock  
25 lever 37 are arranged at a right front portion of the handle 18. An engine switch 53 for driving and stopping the engine E is mounted on a left rear portion of the handle 18. The clutch lever 38 is mounted to a rear portion of the handle 18. The



shift lever 36 extends rearward from the rear center of the power transmission 12 (see FIG. 2). The lifting lever 41 extends rearward from a left rear portion of the connecting mechanism 21.

[0045] The handle 18 is made of a steel pipe formed in a loop, including  
5 handle proximal portions 61, 62 and a handle grip 63. The handle grip 63 consists of left and right horizontal grips 64, 65, left and right rising portions 66, 67 and a cross portion 68.

[0046] FIGS. 4 to 7 illustrate the handle 18 and the clutch lever 38 of the tiller 10 according to the present invention.

10 [0047] As shown in FIG. 4, the clutch lever 38 consists of left and right supported ends 71, 72 swingably supported on the left and right horizontal grips 64, 65 of the handle 18, left and right lever horizontal portions 73, 74 extending rearward from the supported ends 71, 72 in correspondence with the left and right horizontal grips 64, 65, left and right lever forward-tilted portions 75, 76  
15 extending upward from the rear ends of the lever horizontal portions 73, 74 in correspondence with the left and right rising portions 66, 67, and a lever cross portion 77 corresponding to the cross portion 68.

[0048] The left and right horizontal grips 64, 65 of the handle 18 extend rearward from the handle proximal portions 61, 62 shown in FIG. 3 as shown by  
20 arrow ① in FIG. 5 approximately parallel with the traveling surface G (see FIG. 2). The left and right rising portions 66, 67 of the handle 18 are raised via rounded portions 82, 82 from rear ends 81, 81 of the horizontal grips 64, 65 in a direction approximately orthogonal to the handle proximal portions 61, 62 (direction of arrows ②, ②). The cross portion 68 is connected between upper  
25 ends 83, 83 (see FIG. 4) of the rising portions 66, 67. A first stopper 84 for restricting swinging of the clutch lever 38 is provided at the right handle proximal portion 62.

[0049] The supported end 72 of the clutch lever 38 is welded to a shaft member 86 rotatably mounted to the right horizontal grip 65. The supported end 72 has a shape of a flattened steel pipe. A bracket 87 is welded at its one end to the shaft member 86 and has at the other end a wire engaging hole 92 to which the distal end of a clutch wire 90 is connected. The bracket 87 also has a second stopper 91 to abut on the first stopper 84 thereby to prevent further rotation. The clutch wire 90 is pulled via the shaft member 86 and the bracket 87 by swinging the clutch lever 38 toward the handle 18 to turn the clutch on.

[0050] As shown in FIG. 6, the shaft members 86, 86 fixed to the supported ends 71, 72 of the clutch lever 38 are fitted into fitting holes 93, 93 formed in the left and right horizontal grips 64, 65 of the handle 18. As described above, the handle 18 having the left and right horizontal grips 64, 65, left and right rising portions 66, 67 and the cross portion 68 is made of a steel pipe formed in a loop.

[0051] As shown in FIG. 7, the clutch lever 38 is shaped to substantially correspond to the shape of the handle grip 63 of the handle 18 when manually swung in the direction of arrow ③ so that the clutch lever 38 and the handle grip 63 can be manually put together into a single grip to be held (see also the clutch lever 38 in chain double-dashed lines in FIG. 4). Under the resultant clutch engaged state, the tiller 10 moves forward. Conversely, when the hold is released, the clutch lever 38 is returned by a spring to a position shown by chain double-dashed lines, disengaging the clutch, and stopping the tiller 10.

[0052] Now, the method of using the handle 18 and the clutch lever 38 of the tiller 10 will be described with reference to FIGS. 8 to 13.

[0053] FIGS. 8 and 9 illustrate that the cross portion 68 of the handle 18 and the lever cross portion 77 of the clutch lever 38 are held together.

[0054] As shown in FIGS. 8 and 9, for moving the tiller 10 in longitudinal directions (directions of arrows ④, ④) or turn it (in the direction of arrow ⑤), it

is necessary to lift the tilling device 15 and keep it off the traveling surface G. More specifically, an operator M holds the cross portion 68 of the handle 18 by his hands H and pushes the cross portion 68 downward by a force  $F_d$  to lift the tilling device 15 located forward of the travel wheels 13 about the axle 13a of the travel wheels 13. Since the cross portion 68 of the handle 18 is parallel with the axle 13a, it is easy to push the cross portion 68 downward. The clutch lever 38 is held together, so that the tiller 10 moves forward by the travel wheels 13. Thus, a small force  $F_f$  is required for the operator M to move the tiller 10 forward. Accordingly, the operator M can position his arms suitably for maintaining the forces  $F_f$ ,  $F_d$ , maintaining a comfortable work posture.

[0055] For gripping the clutch lever 38, the corresponding shape of the lever cross portion 77 of the clutch lever 38 to the shape of the cross portion 68 of the handle 18 as shown in FIGS. 4 and 7 allows the cross portion 68 and the lever cross portion 77 to be held together. For manually operating the clutch lever 38 to move forward/backward or turn the tiller 10, it is not necessary to change the current positions of the hands H holding the cross portion 68 of the handle 18.

[0056] FIGS. 10 and 11 illustrate the tiller 10 in operation with the left and right rising portions 66, 67 of the handle 18 held.

[0057] As shown in FIGS. 10 and 11, for working the soil with the tiller 10, it is necessary to lift the handle 18 in a direction of arrow ⑥ to cause the tilling device 15 to sufficiently dig into the soil (traveling surface G). Since the left and right rising portions 66, 67 are configured to extend upward from the rear ends of the horizontal grips 64, 65 in a direction approximately orthogonal to the handle proximal portions 61, 62 (see FIG. 5), the oblique application of a pressure force  $F_c$  in a forward and downward direction to the rising portions 66, 67 by the hands H and arms allows the application of the pressure force  $F_c$  to the tilling device 15a in a natural posture. Thus, a comfortable work posture can

be maintained at all times during tilling operations. Specifically, the forward tilting of the rising portions 66, 67 at their upper portions facilitates the oblique application of the pressure force  $F_c$  in a forward and downward direction, preventing the action of needless forces at the wrists and the arms, and  
5 allowing smooth tilling operations.

[0058] The left and right lever forward-tilted portions 75, 76 of the clutch lever 38 has a shape corresponding to the shape of the left and right rising portions 66, 67 of the handle 18 and are arranged in proximity, so that the lever forward-tilted portions 75, 76 can be held together with the rising portions 66,  
10 67. Thus, the need for changing the current positions of the hands holding the rising portions 66, 67 to operate the clutch lever 38 is eliminated, resulting in improved operability.

[0059] FIGS. 12 and 13 illustrate that the horizontal grips 64, 65 of the handle 18 and the lever horizontal portions 73, 74 of the clutch lever 38 are held  
15 together for ridging during tilling.

[0060] As shown in FIGS. 12 and 13, for forming a ridge 94 by the ridger 17 connected to the rear of the tiller 10, the tilling device 15 and the travel wheels 13 shown in FIG. 2 are contacted with the soil (traveling surface G) substantially in the same level to set the ridger 17. That is, it is necessary to  
20 hold the tiller 10 substantially horizontally to the traveling surface G. The hold is maintained by holding powers  $F_u$ ,  $F_d$ . Since the left and right horizontal grips 64, 65 extend approximately in parallel with the traveling surface G, the holding powers  $F_u$ ,  $F_d$  of the hands H and arms can be naturally applied to the horizontal grips 64, 65 to act at the tilling device 15 and the ridger 17 in a  
25 natural posture. The operator can also maintain a comfortable work posture during ridging operation which is simultaneously done with tilling operation.

[0061] Since the loop-shaped handle 18 of the present embodiment is

provided with the left and right horizontal grips 64, 65, it facilitates controls for stabilizing the work position of the tiller body such as lateral balancing of the body or fine adjustment of vertical position of the handle 18, allowing a good result of work such as ridging or ditching.

5 [0062] During ridging operation, the tiller 10 is held substantially horizontally to the traveling surface G by the hands H and arms. The provision of the left and right horizontal grips 64, 65 eliminates the need for unnaturally bending the wrists and arms, allowing maintaining a comfortable work posture.

[0063] Since the left and right lever horizontal portions 73, 74 of the clutch  
10 lever 38 correspond in shape to the left and right horizontal grips 64, 65 of the handle 18, they can be held together. It is thus also needless to change the current positions of the hands holding the horizontal grips 64, 65 for operating the clutch lever 38 during ridging operation.

[0064] As shown in FIG. 6, the handle 18 has a simple configuration made of  
15 a steel pipe formed in a loop including the left and right horizontal grips 64, 65, left and right rising portions 66, 67 and cross portion 68, resulting in reduction in handle production costs.

[0065] Obviously, various minor changes and modifications of the present invention are possible in the light of the above teaching. It is therefore to be  
20 understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.